RESEARCH DEPARTMENT

TELEVISION SERVICE — ISLE OF MAN

Report No. K-126

(1957/14)

THE BRITISH BROADCASTING CORPORATION
ENGINEERING DIVISION

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SUMMARY

The problem of providing the Isle of Man with a television service in Band I is discussed. It is shown that the west coast of the Island, including Peel, receives a satisfactory service from Divis and the northern sector, including Ramsey, will receive a satisfactory service from the proposed transmitter at Sandale.

Because these areas will be so served and because a temporary transmitter already serves Douglas with a much stronger signal than could be provided from Snaefell, it is recommended that the Snaefell site originally chosen to serve the *whole* Island should be abandoned in favour of the site used for the temporary service at Carnane, near Douglas.

A site on Snaefell should, however, be used as a receiving point for direct pick-up of the television programme from either Sandale, Holme Moss or Divis.

1. INTRODUCTION

The television distribution plan provides for a low-power transmitter to serve the Isle of Man with a vertically polarised transmission on Channel 5. The obvious choice of a site for this transmitter was the summit of Snaefell, the highest point of the Island (2038 ft (621 m) above sea level). The use of this site was originally considered in 1953 but, because of difficulties arising from sharing the site with the Ministry of Transport and Civil Aviation, who operate a radio station for air to ground communication, the scheme was at that time abandoned and an alternative site sought.

A temporary low-power transmitter was then brought into service at Carnane, a site overlooking Douglas, and it was recommended that the effective radiated power (e.r.p.) should be 1 watt. Unfortunately, local pressure resulted in the power being increased to 250 watts with the result that the median field strength in Douglas was increased from 2·5 mV/m to 40 mV/m.

An alternative site to Snaefell for the permanent transmitter was found at Injebreck Hill but tests[1] showed that this site would give only a very poor service in parts of Douglas and at the southern end of the Island. The report concluded: "Many complaints would be received from viewers who are getting a satisfactory service from the temporary transmitter at Douglas (Carnane) if the service were transferred to Injebreck Hill".

As a result of this, further consideration was given to siting the transmitter on Snaefell. Negotiations were reopened with the M.T.C.A. and tests were made to determine the degree of interference their service would suffer if the B.B.C. operated a low-power station on a shoulder some 1000 ft (305 m) south-west of the summit and 1957 ft (596 m) above mean sea level. These initial tests were successful and were followed by the survey described in this report.

2. GENERAL

The test transmissions from Snaefell consisted of a peak-white picture and line synchronisation pulses radiated by a 500-watt vision transmitter driving two dipoles stacked vertically, their centres spaced $\frac{3}{4}\lambda$ from one another and spaced $\frac{1}{4}\lambda$ from a 5½ in. (14 cm) diameter tubular mast. The height of the centre of the aerial was 88·5 ft (27 m) above ground level. The directional properties of this aerial were allowed for and all field strengths quoted have been corrected to correspond to the value for an omnidirectional aerial and an e.r.p. of 0·8 kW.

When the weather permitted, the test transmissions were radiated by a balloon-borne aerial up to a maximum height of 300 ft (91·4 m) above ground level. All field strength measurements were made with a receiving aerial 15 ft (4·6 m) above ground level but they have been corrected, on a linear height-gain basis, to the values for 30 ft (9·2 m) above ground level.

Observations of the transmission when modulated with "spike" or Test Card C were made at a number of points in the Island in order to determine the degree of sea scatter interference* that would arise if the permanent transmitter were sited on Snaefell.

The field strength of the Divis and Sandale (temporary) transmissions was also measured to determine the effectiveness of the coverage over the western and northern areas of the Island.

Details of all relevant sites are given in the Appendix.

3. ELECTRICAL INTERFERENCE IN THE ISLE OF MAN

The electric power distribution lines on the Island cause very serious interference with the reception of television signals. With the exception of Douglas, the entire Island is served by 11 kV and 33 kV lines, and, under most atmospheric conditions, serious arcing occurs. The precise mechanism of the arcing is not known but the intensity of the interference, which varies with the time and location, is often very severe.

*Sea scatter interference is the subject of a Research Department report to be published shortly. Briefly, this form of interference may be experienced at a receiving point within about one mile (1·6 km) of the sea, severely screened from the transmitting source by a local obstruction, if the surface of the sea is illuminated by a strong field within a few miles of the shore. In these circumstances the direct signal is seriously attenuated but, under certain sea conditions, a relatively strong scattered signal is received from the sea, which is alternately in and out of phase with the direct signal due to the motion of the waves. The interference manifests itself as a series of ghosts of diminishing amplitude and rhythmic change of phase. When the interference is severe the synchronising pulses are so blurred as to cause the picture to disintegrate.

It is not possible to state the field strength required to suppress the interference in all areas of the Island but it is felt that 0·5 mV/m should provide reasonable reception for most of the time, except in cases of severe interference.

4. THE SERVICE IN THE ISLE OF MAN FROM DIVIS AND THAT EXPECTED FROM THE PERMANENT SANDALE TRANSMITTER

In considering the siting of the permanent transmitter in the Isle of Man account must be taken of the service now provided by Divis and that which will be provided by Sandale when it comes into full service.

A survey (including, on account of power line interference, sample viewing) of the service from Divis was carried out, and the results are presented in a field strength contour map in Fig. 1 (map T.357). The service expected from Sandale (final condition), based on measurements of the temporary transmissions, is shown in Fig. 2 (map T.358).

From Fig. 1 it will be seen that Divis now provides the whole of the Island, except the east coast, with a field strength of at least 0·1 mV/m and that the west coast towns of Port Erin, Peel and Jurby all receive median field strengths in excess of 0·5 mV/m. The Sandale transmitter in its final condition is expected to serve the northern plain, the median field strength in Ramsey being 1·0 mV/m.

The field strengths in the principal towns in the Island from Divis and Sandale are tabulated in Table 1.

TABLE 1

Field Strength in mV/m at 30 ft (9·2 m) AGL

Town	DIVIS E.R.P. 12 kW Measured Max.	Median	Min.	SANDALE E.R.P. 25 kW in I.o.M. direction Derived from low-power measurements Max.	Median	Min.
Douglas	0·9	0·18	Noise			
Ramsey	0·9	0·26	0·09	3·0	1·0	0·35
Peel	1·6	0·56	0·18			
Laxey	0·14	0·04	Noise	The field strength in the other towns was too weak for accurate measurement on the present low-power condition.		
Castletown	0·7	0·33	0·18			
Port Erin	2·0	0·5	0·09			
Port St. Mary	1·0	0·32	0·1			

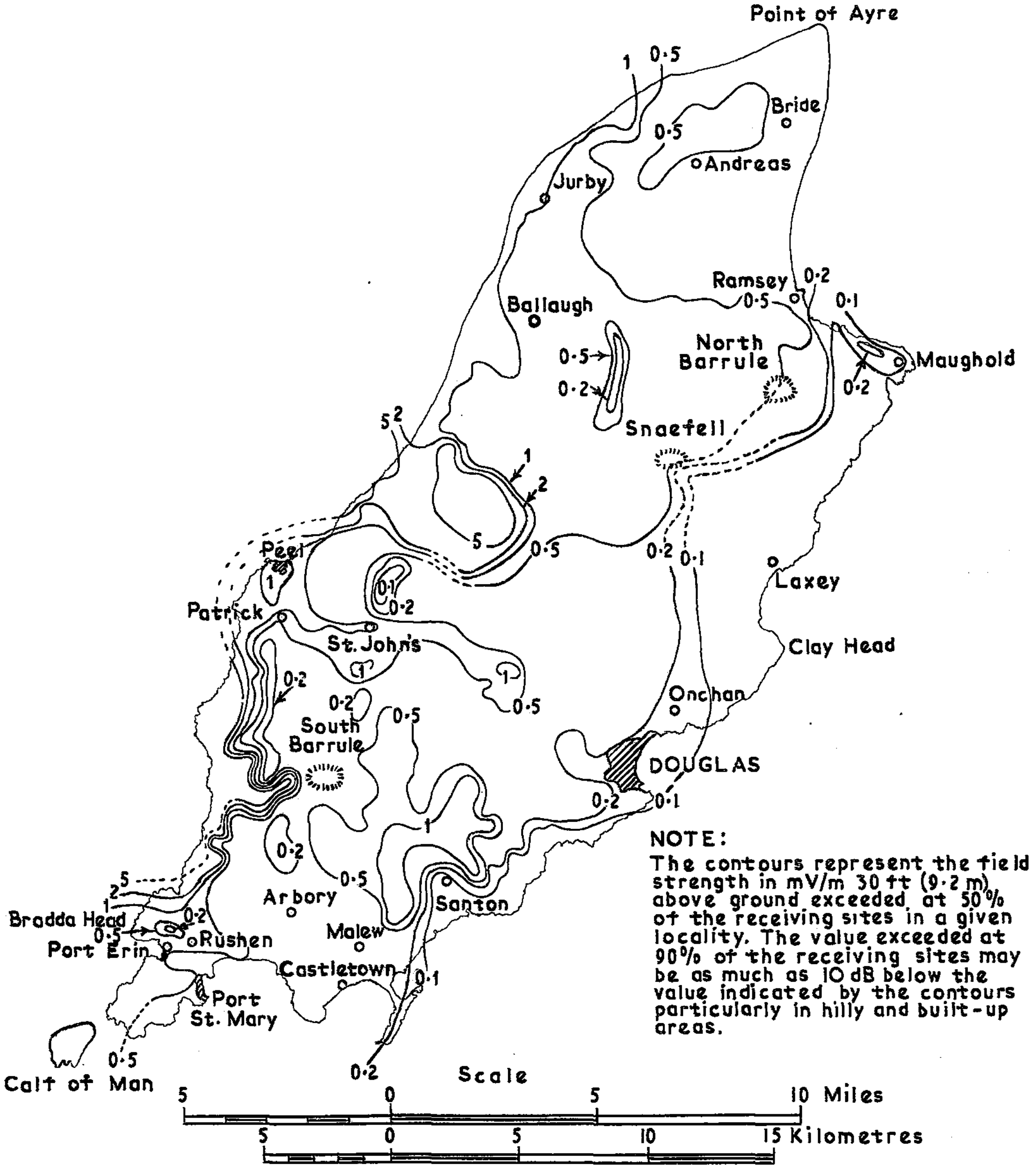
From Table 1 it will be seen that many towns on the south and west coasts of the Island receive a field strength from Divis which, in the absence of power line interference, would provide a good service. Because of this interference subjective tests were made at a number of towns including Peel, Port Erin and Ramsey. Two visits were made to Peel. On the first occasion the interference was severe in one locality whilst on the second it was negligible in all parts of the town. In Port Erin the interference, generally, was graded as being "slightly disturbing".

DIVIS
Field strength contours in the I.O.M.
(Measured)
Channel 1 (45 Mc/s)

T 357

Fig. 1

Site Height: 1200 ft (365m) AMSL
Aerial Height: 475 ft (145m) AGL
E.R.P. : 12 kW
Aerial: 3 tier superturnstile
Polarisation: Horizontal



NOTE:
The contours represent the field strength in mV/m 30 ft (9·2 m) above ground exceeded at 50% of the receiving sites in a given locality. The value exceeded at 90% of the receiving sites may be as much as 10 dB below the value indicated by the contours particularly in hilly and built-up areas.

T358.

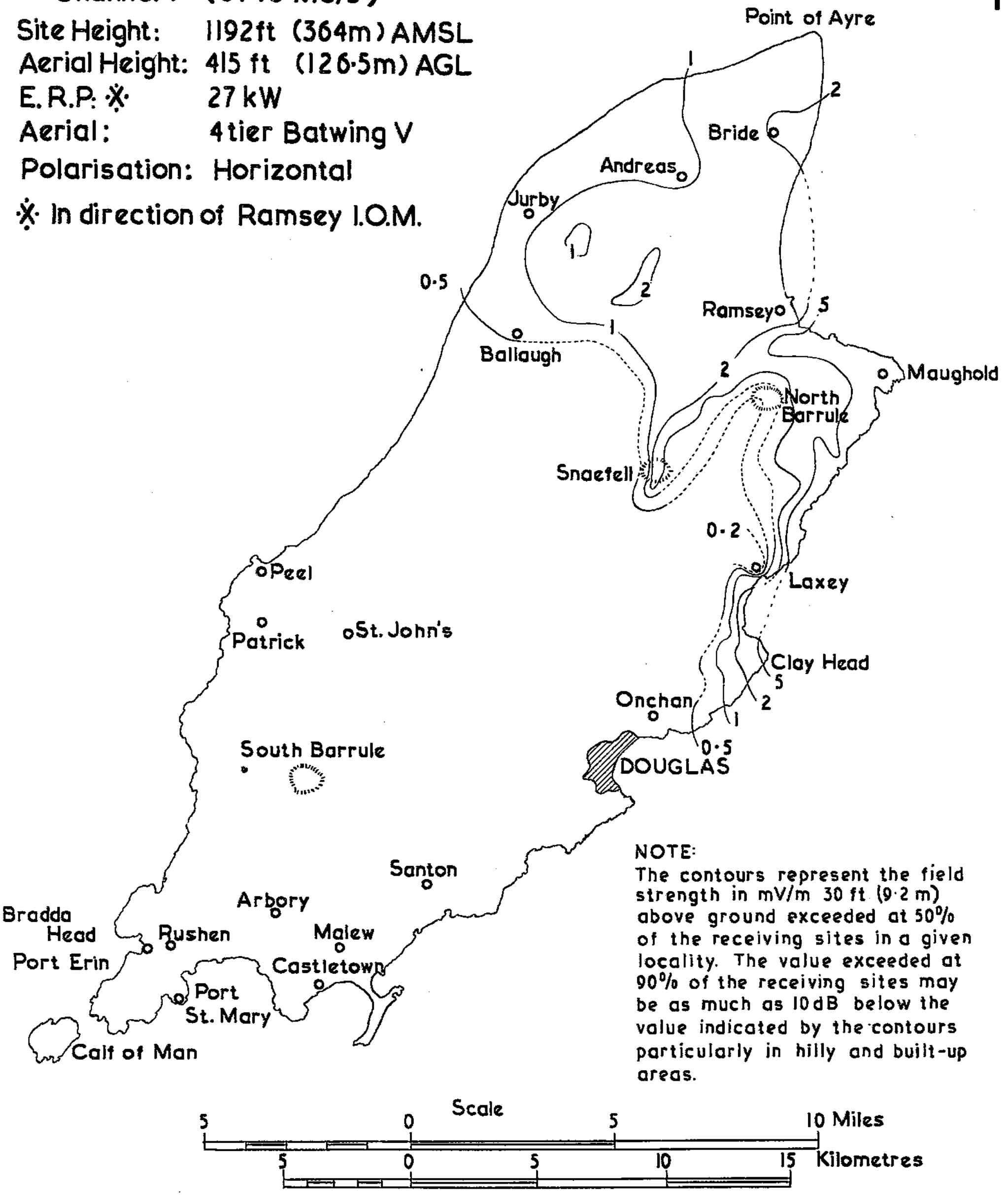
Fig.2

SANDALE

Field strength contours in the I.O.M.
(Derived from measurements of temporary low power transmitter)
Channel 4 (61·75 Mc/s)

Site Height: 1192 ft (364m) AMSL
Aerial Height: 415 ft (126·5m) AGL
E.R.P. ·X· 27 kW
Aerial: 4 tier Batwing V
Polarisation: Horizontal

·X· In direction of Ramsey I.O.M.



NOTE:
The contours represent the field strength in mV/m 30 ft (9·2 m) above ground exceeded at 50% of the receiving sites in a given locality. The value exceeded at 90% of the receiving sites may be as much as 10 dB below the value indicated by the contours particularly in hilly and built-up areas.

In Ramsey all viewers at present rely upon Divis for their service but many parts of the town suffer from severe power line interference. When, however, the Sandale transmitter comes into full service the field strength is expected to be sufficient to overcome most of the interference.

The Divis and Sandale (final condition) transmissions may, therefore, be regarded as serving the west coast and the northern plain and it only remains for the local transmitter to serve the southern half of the Island, i.e., that part south of a line from Douglas to Peel, since, with the exception of Laxey, the intervening area is mountainous and very sparsely populated.

5. THE SNAEFELL AND DOUGLAS (CARNANE) SITES

Fig. 3 (map T.354) shows the service provided by the Isle of Man low-power transmitter if sited near the summit of Snaefell. It will be seen that the overall coverage is very good and there is no doubt that Snaefell would be the best site for the transmitter if no other service was provided. As matters stand, however, the Snaefell service area would overlap that of Sandale in the north while many parts of the west coast are as well served by Divis as they would be from Snaefell; in fact, those parts of Peel and Port Erin nearest to the sea are better served by Divis than they would be by Snaefell. The existing service in Douglas from the Carnane transmitter is very much in excess of that expected from Snaefell. Table 2 shows the comparison between the service provided from Snaefell and Carnane.

TABLE 2

Field Strength in mV/m at 30 ft (9·2 m) AGL

Town	SNAEFELL Aerial 210 ft (64 m) AGL 800 watts (Derived from site tests)			DOUGLAS (CARNANE) Aerial 40 ft (12·2 m) AGL 250 watts (Measured)			Aerial 210 ft (64 m) AGL 800 watts (Calculated)
	Max.	Median	Min.	Max.	Median	Min.	Median
Douglas	32	4·4	0·24	80	46	14	100
Ramsey	30	4·5	0·1	0·03	0·02	0·01	0·08
Peel	3·8	0·9	0·25	0·6	0·2	0·05	0·53
Laxey	110	11	1·3	0·44	0·06	0·03	0·27
Castletown	5·8	2·2	0·6	0·5	0·3	0·1	1·8
Port Erin	2·2	0·3	<0·13	0·4	0·2	0·05	0·5
Port St. Mary	5·4	2·5	1·0	0·7	0·3	0·1	0·9

It will be seen that while the median field strength in Douglas from Snaefell is 4·4 mV/m the minimum value is only 0·24 mV/m, some 40 dB less than the field strength now received from the temporary Douglas (Carnane) transmitter. Details of the service provided in Douglas by a transmitter sited at Snaefell are given in Fig. 4 (map T.375) and since the general level of electrical (including motor ignition) interference is extremely high, reception in many parts of the town would be materially worse than that to which residents have become accustomed. Those areas of Douglas subject to low field strengths would also suffer from severe sea scatter interference.

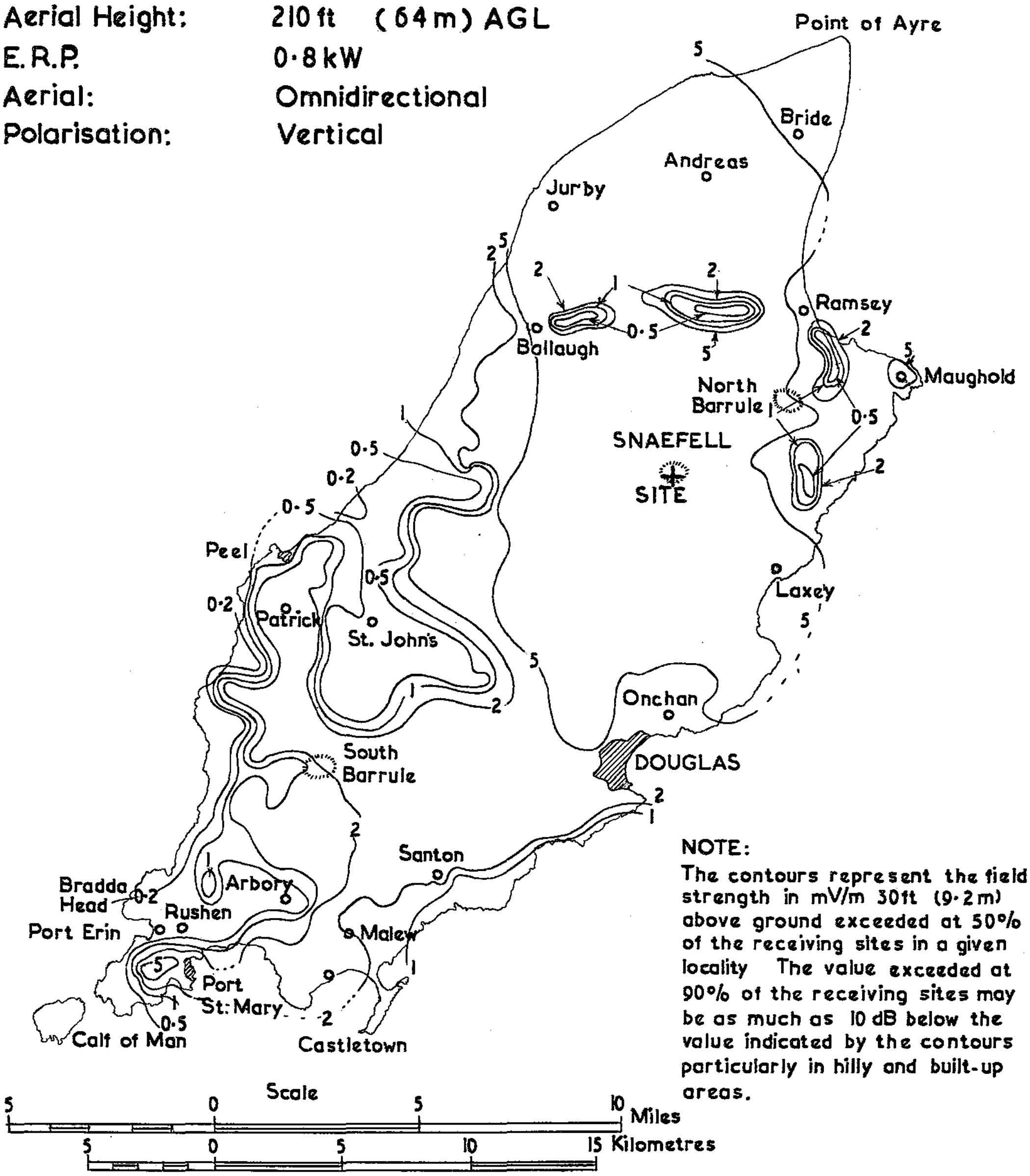
T354

Fig.3

SNAEFELL

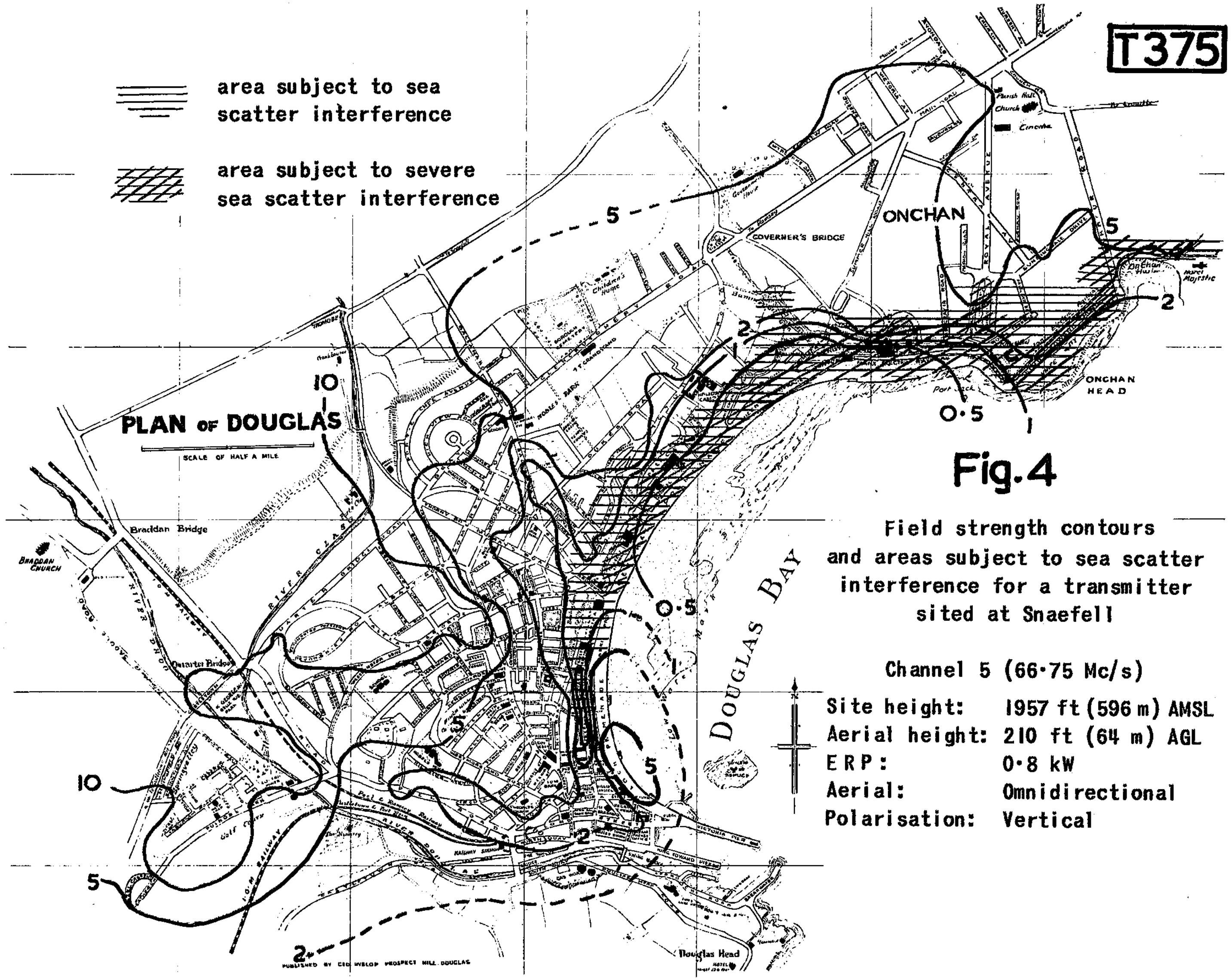
(Derived from site test measurement)
Channel 5 (66·75 Mc/s)

Site Height: 1957 ft (596 m) AMSL
Aerial Height: 210 ft (64 m) AGL
E.R.P. 0·8 kW
Aerial: Omnidirectional
Polarisation: Vertical



NOTE:
The contours represent the field strength in mV/m 30 ft (9·2 m) above ground exceeded at 50% of the receiving sites in a given locality. The value exceeded at 90% of the receiving sites may be as much as 10 dB below the value indicated by the contours particularly in hilly and built-up areas.

T375



☰ area subject to sea scatter interference

▦ area subject to severe sea scatter interference

Fig.4

Field strength contours and areas subject to sea scatter interference for a transmitter sited at Snaefell

Channel 5 (66·75 Mc/s)

Site height:	1957 ft (596 m) AMSL
Aerial height:	210 ft (64 m) AGL
ERP:	0·8 kW
Aerial:	Omnidirectional
Polarisation:	Vertical

Subjective tests made in many parts of the Island showed that parts of Laxey and Ramsey as well as those parts of Douglas near the front would suffer varying degrees of this interference and that, in some areas, it would be serious. The areas of Douglas subject to sea scatter effects are shown in Fig. 4.

Finally, the possibility of siting the permanent low-power station on or very near the site of the temporary station at Douglas (Carnane) is considered. The service area for this site, estimated from field strength measurements of the temporary transmitter, is given in Fig. 5 (map T.362) and Table 2. Douglas would receive a median field strength of about 100 mV/m and all viewers on the Island who have in the past received their service from the temporary station would, of course, receive an enhanced signal. As in the case of Snaefell, however, certain parts of the west coast would be better served by Divis. Douglas (Carnane) would not contribute anything to the service in the northern plain and, although the field strength in Laxey will be enhanced, it will not provide a strong enough signal to overcome power line interference, especially in the lower parts of the town.

6. TELEVISION LINK WITH THE MAINLAND

The present arrangement for feeding programme to Douglas (Carnane) is direct pick-up of the programme from Holme Moss. This radio link is subject to severe fading and during the summer months continental co-channel interference, due to propagation by Sporadic E, is sometimes very serious.

It is proposed to establish a receiving post on the summit of Snaefell, where the field strength from Holme Moss is substantially greater than it is at Douglas (Carnane), and feed the programme to Carnane by an S.H.F. link. The field strength of Holme Moss on the temporary transmitter site near the summit of Snaefell was recorded for 163 hours with a receiving aerial 30 ft (9·2 m) above ground level. Details of the observations are given in Table 3.

TABLE 3

Percentage Time	50	60	70	80	90	95	99	100
Field strength (mV/m) 30 ft (9·2 m) AGL exceeded for given percentage time	2	1·9	1·75	1·6	1·4	1·25	1·0	0·5

The signal stability of Holme Moss on Snaefell should, therefore, be satisfactory but the Sandale transmissions should provide a more satisfactory link for the following reasons:

i. The field strength, even while Sandale is running a temporary service, should be adequate for first-class reception.

ii. Sandale is only 63 miles (101 km) distant, whereas Holme Moss is 118 miles (190 km). Fading should, therefore, be negligible.

iii. Signals from Sandale, on Channel 4, will be subject to much less Sporadic E interference than those from Holme Moss on Channel 2.

DOUGLAS (CARNANE)
(Estimated)

T362

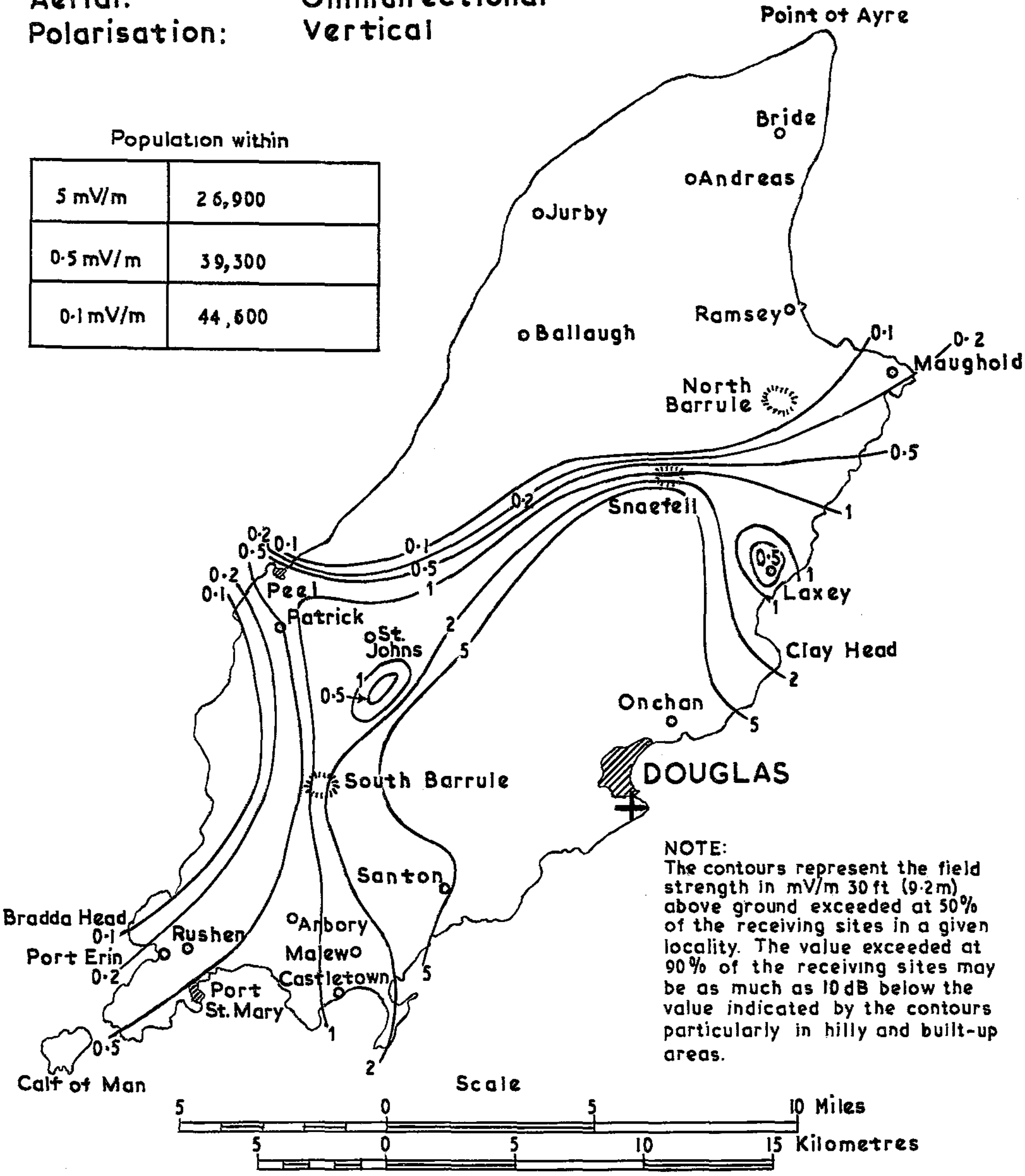
Fig.5

Channel 5 (66·75 Mc/s)

Site Height:	491ft (149m) AMSL
Aerial Height:	210ft (64 m) AGL
E.R.P.:	0·8 kW
Aerial:	Omnidirectional
Polarisation:	Vertical

Population within

5 mV/m	26,900
0·5 mV/m	39,300
0·1 mV/m	44,600



NOTE:
The contours represent the field strength in mV/m 30ft (9·2m) above ground exceeded at 50% of the receiving sites in a given locality. The value exceeded at 90% of the receiving sites may be as much as 10 dB below the value indicated by the contours particularly in hilly and built-up areas.

iv. Because the Sandale transmissions are horizontally polarised and because of the geographic disposition of the Sandale/Snaefell link in relation to the continent a large measure of discrimination against Sporadic E interference should be possible by suitably orienting the aerial. Further, since the field strength from Sandale will be much in excess of the minimum required for good reception it may be worth while considering erecting a low receiving aerial at Snaefell with a view to steering it for minimum interference under any given set of conditions. Adjustment of directivity will also be necessary to avoid co-channel interference from Meldrum.

The field strength of Divis was also measured near the summit of Snaefell and the transmission provides a strong reliable signal for R.B.R. purposes if required.

7. CONCLUSIONS

Having shown that Sandale (final condition) will provide a field strength of at least 0·5 mV/m in the northern plain, that Divis now provides not less than 0·5 mV/m to the west coast and that if the low-power transmitter be sited on Snaefell parts of Douglas would be subject to very poor reception, it is concluded that Douglas (Carnane) is the best site for the Isle of Man permanent station. With this arrangement (see composite map T.363, Fig. 6) Engineering Information Department have estimated that 95% of the Island's population will receive a field strength in excess of 0·5 mV/m. To site the transmitter at Snaefell would undoubtedly cause complaints from viewers in large areas of Douglas who would receive a much degraded picture compared with that to which they are accustomed. Furthermore, reception of Snaefell in parts of Ramsey, Douglas and Laxey would be seriously marred by sea scatter interference.

A receiving post will, however, have to be established on Snaefell if a good programme link is to be provided for the permanent station and it is recommended that, whenever practicable, the Sandale transmission should be used.

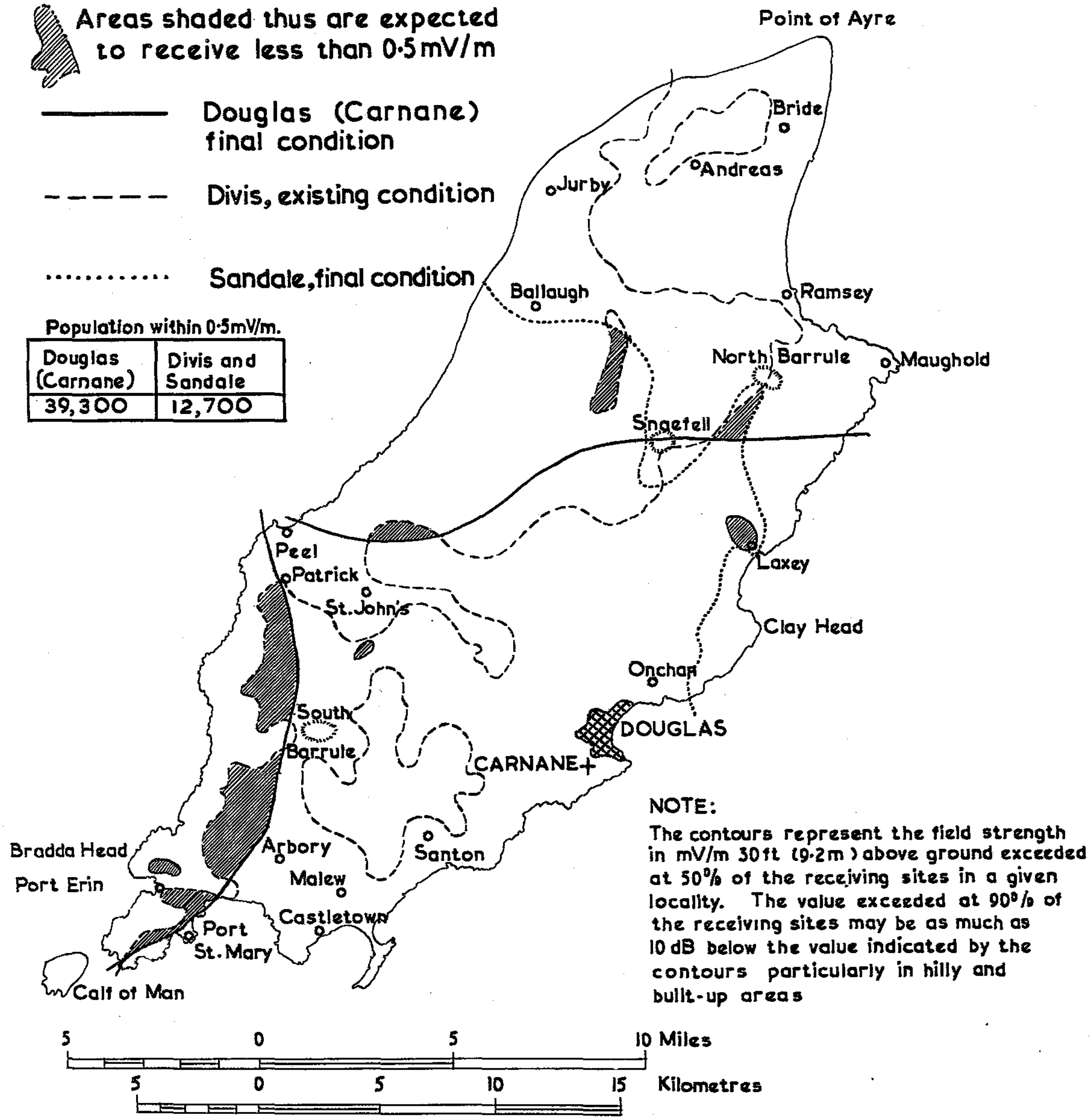
8. REFERENCE

1. Research Department Report No. K-103 (1955/7), "Television Service for Isle of Man — Site Test at Injebreck Hill".

Composite field strength contour map showing the 0·5mV/m contour of the Divis, Sandale and Douglas (Carnane) television transmitters

T363

Fig. 6



▨ Areas shaded thus are expected to receive less than 0·5mV/m

——— Douglas (Carnane) final condition

- - - - - Divis, existing condition

··········· Sandale, final condition

Population within 0·5mV/m.

Douglas (Carnane)	Divis and Sandale
39,300	12,700

NOTE:
The contours represent the field strength in mV/m 30ft (9·2m) above ground exceeded at 50% of the receiving sites in a given locality. The value exceeded at 90% of the receiving sites may be as much as 10 dB below the value indicated by the contours particularly in hilly and built-up areas

APPENDIX

Snaefell

Latitude:	54° 15' 40" N
Longitude:	04° 27' 49" W
Grid Reference:	24(SC)/396880
Height above sea level:	1957 ft (596 m)

Douglas (Carnane)

Latitude:	54° 08' 25" N
Longitude:	04° 29' 32" W
Grid Reference:	24(SC)/373746
Height above sea level:	491 ft (149 m)

MM